

3C: Communicating Environmental Science

David Sale, Puget Sound Water Quality Action Team: The idea of this session is to highlight some issues that come up when we try to communicate scientific information to the public. And trying to go both ways with it, to get the information communicated to scientists. When we first started putting the session together, we had a conference call that really took off. It was a nice open dialogue. We decided that we should try to accomplish the same during this session. Each person will come up and introduce himself, and will have about five minutes here to talk about some issues that are important from their perspective. Then we're going to shift to an open dialogue.

Ross Anderson, Seattle Times: I never dreamed I'd be sitting in front of a bunch of scientists trying to pass on wisdom. I mean, reporters, we make our living, more often than not, sitting in the back of the room sipping somebody else's coffee making fun of the people sitting up here. And that includes an occasional conference of scientists. It was a very strange idea, coming down here, but excellent.

I'm a classic example of a journalist who went to college in the late 1960's. I've never darkened the door of a biology class. I went to school when social sciences ruled the day, and we were all going to save the world with social science and politics and, of course, journalism. Natural sciences were pretty far afield.

I've been at the Times 25 years and I've written mostly about politics. But you don't write about politics in the Northwest, of course, without writing about natural resources. So I find myself at conferences like this, sitting in the back, sipping somebody else's coffee, and making fun of the people who are up here, trying to understand what's going on.

So that's how I ended up, last year, at the AAAS conference. I was sort of vaguely aware that AAAS existed, but then as I learned more about it, I realized that it was an extraordinary opportunity. So I ended up spending most of the week roaming, this wonderful freedom, I'd roam from one session to the next. Of course, didn't understand a whole lot of what was going on.

But one of the things I was fascinated with was this curious relationship between science and journalism. I remember writing about it at the time, and referring to journalists trying to find something newsworthy that could be translated into a newspaper, or radio, or TV story. It's a very curious relationship between science and journalism. It's one that fascinates me.

I've decided in the last few years that in my next life, I want to come back as a marine biologist, and not a journalist. It's also a volatile relationship, obviously.

Scientists distrust journalists because they believe, quite correctly, that we have very little understanding for what they do, or what you all do and how you do it. And that your work tends to get fractured in the re-telling. And journalists, by the same token, are sort of equally wary of scientists because we suspect, with good reason, that you all spend many, many years in graduate school learning how to obfuscate the English language, and torture it in the process. But yet, public policy these days is increasingly based on some combination of good science and good journalism. So we kind of need each other, which is why, I assume, we're all here.

The fascinating thing is that, I think, we are all in the same business. If you peel away everything else, we're all in the business of trying to increase the understanding of the human race about the world that it lives in. This is obviously a noble undertaking for which we feel, sort of, equally under appreciated and underpaid. But similarities all end there. I'm going to indulge in some sweeping generalizations in trying to compare what we do for a living. While, in this dogged pursuit of truth, we ask different questions.

Scientists ask what is this and how does it work, and journalists ask so what, why does it matter, why is this important? Which gets us both in trouble, especially when we deal with issues such as risk assessment. We have a tendency, in my business, to take important but incremental research on a

potential carcinogen and turn it into a cure for cancer. And we do it all the time. It drives you crazy, and I don't blame you.

Another difference; scientists are specialists. You guys know a lot about a few things. Journalists tend to be generalists who know very little about a lot of things. Scientists tend to work for government. Most reporters don't work for government and, in fact, we see our role, in part, as sort of a monitor of government. So when we deal with scientists, there is almost this, sort of, almost unconscious impulse to look for some way that you guys are wasting tax dollars.

I think the most important difference is the way we go about that search for truth. We go by entirely different rules and disciplines. Scientists' conclusions are drawn from data and derived from repeated experiments. Right? I don't understand them but I know that's roughly how you do it. Your bible is the scientific method; an orderly process of inquiry that requires precision and testing of hypotheses, and so forth. Reporters, our scripture is the democratic process; especially the first amendment. We value freedom of speech and an open exchange, which has nothing to do with precision. We value our constitutional right to be dead wrong about something. We mix science with politics, and economics, and business, and sports. We try to track the flow of money, and we love to speculate about why people do what they do. I have a lot of friends who are scientists, and I try to explain this, and they find it highly amusing. We believe the truth emerges from the conflict of ideas. If we depict both sides of an issue, somehow, in some mysterious, magical way, truth will emerge. This, of course, has nothing to do with what scientists do for a living.

But maybe the most important difference between what we do is, obviously, that journalists are communicators. We believe that knowledge and ideas are valuable only to the extent that they are communicated. To do that, we resort to things like storytelling and anecdotal evidence that, of course, is not evidence at all. That's another thing that drives my friends crazy. To us, if something that is lost in the re-telling. It's too bad. We did our best.

Scientists are into knowledge for knowledge sake, and, most times, my friends tend to be loners. They work alone. They conduct their experiments alone, and sort of occasionally submit their findings to other scientists for peer review; usually in a language that is unintelligible to anybody else.

An example to me is, Puget Sound marine science, I never darkened the door of a biology classroom, but I've written about it enough, so I probably know a little bit more about marine science than most people walking the streets. And yet, I spent some time in the poster session out here, and I would say that three-fourths of those posters, I don't understand, what we're talking about. I think this is the problem for science. For starters, it feeds the purpose for those people who shall remain anonymous that argue that government already spends too much money on pointy-headed scientists, that science should do that in the private sector.

An example, I write about fisheries a lot. I'm fascinated with them, mostly with the culture of fisheries and the process of that. I have indulged, now and then, in the science. And I remember, some years ago, going up to NMFS out at Sand Point to talk to a scientist, who will remain anonymous, who some of you may know, and who had done some work that basically argued that the way to preserve pollock in the north Pacific was to catch more pollock. I found this absolutely intriguing. I read a little bit of his stuff, but mostly I had heard through the grapevine. I called him up and it took me weeks and weeks to talk him into letting me come out to talk to him. So I went out and talked to him. He was a delightful character. He reminded me of the chef on the Muppets. I could've sworn he had a chef's hat, and he was brilliant. But for about a half an hour he'd talk, I was sitting in this little cubbyhole of a room and this is one of those biologists that does all of his work at this computer monitor, right? And he had his model and he was trying to explain to me how this worked. And I was getting frustrated because I didn't understand. He was getting frustrated because, Mr. Anderson, you don't understand that pollock eat pollock. And I was like, why didn't you tell me that first? They're cannibals? He says Mr. Anderson, I've been trying to tell you that for half an hour. I wish he'd have just explained that at the outset. I mean, I understood that. I can understand how this is a problem.

Now the flip side of that, I suspect that many of you, most of you probably know Don (?). Don was a reporter's dream. He died about a year ago, and I miss him desperately. But Don was that rare case of a scientist who, in addition to fisheries science, understood politics. He understood economics. He understood and he appreciated and he spoke English. So I would run these questions that I couldn't resolve with anybody else, and he would sort of patiently explain it to me.

I'm going to give you one more example. I don't know how many of you are familiar, or worked with Ray Troll, the Alaska artist. The salmon guy. "Spawn till you die." "Tankers from hell." He's best known, unfortunately, for his T-shirts because his T-shirts sell remarkably well, and he's made a lot of money off T-shirts.

Troll is sort of half artist and half scientist, and his true love, his true passion, is paleontology. He loves fossils, and he and a guy by the name of Brad Mattson collaborated on a wonderful book called Planet Ocean. And it's a book about paleontology of the oceans. After the book, which was wonderfully illustrated with Ray Troll drawings to support [it], afterwards they had a one of a kind exhibit at the Burke Museum in which they had the Ray Troll drawings of these wonderful, ancient, prehistoric creatures. And then examples of the fossil evidence that sort of suggested those creatures.

The interesting thing is how he arrived at those drawings. I did a column about it at the time, and basically the way that they got there, he drew these wonderful saber-toothed salmon, just these wonderful, fanciful creatures. But the problem was that none of the paleontologists would draw them. There were, of course, no pictures, and apparently the fossil evidence is all fragmentary. And so what Ray would do is he'd sit down with these guys, take a look at the fossil evidence, and, you know, draw as best he could. And then he's take it to these scientists, to these paleontologists and say, this is what it looked like. They'd say, no, it's not like that. He'd say OK, and he'd go back and he'd draw it again, and bring it to the paleontologists and say, is this what it looked like. And they'd say, no, that's not it. Try again. And then, that's it, you've got it, but don't you ever tell anybody I told you so.

This is sort of the journalists' version of peer review, but it worked. I think, perhaps, somewhere in there, there's a model for how your profession and my profession could make things work a little bit. Reporters are, I think, are obligated to improve our understanding of how you work, and our understanding of the discipline, of the science, of statistics and of risk assessment, and what is the risk, and what ain't. We can't continue to use ignorance as a fence. We need to resist that impulse to turn incremental advances in scientific knowledge into journalistic touchdowns. But scientists are equally obligated to resist their impulse to hibernate, to operate behind closed doors. They need to learn the basic communication skills that everybody else in the world has to abide by, beginning with the use of the English language. For all our "cure for cancer" stories, scientists are equally guilty of poor risk management when they use the risk of miscommunication as the rationale for not communicating at all. Thanks.

Bruce Brown, Independent Journalist: Greetings, my name is Bruce Brown. I am here for a variety of reasons. I am the author a book called Mountain and Clouds: A Search for the Wild Salmon. I wrote the scripts for a PBS TV series called *The Miracle Planet*. This doesn't really have bearing on what we're talking about this evening, but I am, among other things, the author of Mr. Wacko's Guide to Slow-Pitch Softball and creator of Mr. Pizza, of which we will say no more. But I am also, in my current incarnations, the owner and publisher of an electronic publishing firm which is probably best known for a web publication called Bug Net.

In some of the facets of my professional existence up to this point, I had an opportunity to try my hand and to wrestle with some of the challenges which I think are the fundamental subject we are talking about here, and which, perhaps, could be stated as the need to communicate important information that may be somewhat complex. That which may be beyond what can be easily stated in a simple declarative sentence, and yet has real bearing on people's lives. And one of the things that has occurred to me incrementally over the years that I have wrestled with this creature in the mud, and one media and another is that the medium is the message. A cliché perhaps, but as with many clichés, one that perhaps

contains a kernel of truth.

As I have tried to skin a cat from one side and another, a bad pun or metaphor I'm sure perhaps in this group, but as I have basically approached the issue of communicating scientific information, information which has a strong scientific aspect, to people in the general community I have become increasingly convinced that the medium that is employed at any given time really has a significant effect on what you can say. In other words, it shapes your message to a significant degree. I don't have the time and I wouldn't impose upon you, or presume to take the time that would perhaps be required to march through each chapter of my checkered past, and perhaps extract a kernel or the aspect of it which may pertain. But I'd like to tell you a couple of stories, if I could, from one or two facets of my professional involvement with this undertaking.

I think off the top of TV script writing, which is a lot of fun in a way. I mean you get to spend weeks, months, years playing with high tech gear and watching pictures go back and forth and listening to your own words be read, studied, and ripped apart at times. But it's ultimately staged in a lavish fashion, and it's real neat for all the reasons that television is a powerful medium. You see the glitzy surface that can be applied. I've found myself, as a newspaper reporter, first and foremost, a journalist, basically, as I saw myself, and subsequently, as a book author, somewhat surprised by the way television shaped the message that we were trying to communicate. And in *The Miracle Planet*, which was actually one of the most popular series that PBS has ever done, being viewed probably somewhere in the world right now, kind of like Stairway to Heaven. Somewhere in the world at any time, translated into seven languages.

As we got into [the making of *The Miracle Planet*], we found that sometimes things didn't really quite work out like we expected. For instance, it's all verbal. And you say, well of course it's all verbal, Bruce, in terms of cognitive communication, except for what you can do with images. But when I say it's all verbal, what I mean is, it all exists in the moment. You can't flip back and refer to a table. You can't go to the page before and refresh your memory on the definition of paleontology. You have to be able to hold it in the moment and you have to be able to understand it and deal with it comfortably in its totality in the moment, and make the references that are required with the idea in the moment. These requirements are more difficult than you might expect.

Then there is simply the limitation of the spoken language, which is of course a wonderful thing, but then we have inherent in it certain limitations. I remember, we went through maybe the fourth draft with a reference in one of the shows to the "rebooladooble" plateau. I have to say parenthetically here by way of explanation, *The Miracle Planet* was KCTS first big play in the national stage, and there was a lot of subtext and some ego of various people who shall remain nameless. One of the things they had done was essentially to license from Nippon Television a whole lot of gorgeous footage. And so they had this store, and they had for the basis for what became *The Miracle Planet*, a Japanese television series that dealt with somewhat the same subject. And so we were handed these scripts, and translations from the Japanese, as the first phase in producing what became six one-hour shows for American PBS, and eventually translated into every language but Japanese. So through four drafts from what had begun with the Japanese translation of the basis material, we're hearing this thing about the "rebooladooble" plateau and finally someone said, because the fact checkers were always combing, "What is this 'rebooladooble' plateau thing"? And so the various reference books were consulted and so then the question of spelling was raised, and finally, Nippon television was queried on this aspect of the script. And it turned out that it was a Japanese mispronunciation with the stereotypic confusion of l's and r's for Labrador. What they were trying to say was Labrador, and yes this made sense, great Canadian shield, you know. And we're talking about, you know we have a geologic reference point now, you know, and it made sense. But existing exclusively as a verbal form of communication, you know, it had a kind of an inadvertent problem that took a long time to work out.

Another thing that struck me was something I never would have thought of before I had to write words to put into someone else's mouth, what you know the writer thinks of as the talking head, a lesser form of life. Animated only by my brilliant prose, but it doesn't really quite work that way because this guy is, you know, he's the star. Welcome to the party, Bruce. This guy, he's the one they brought in, at huge

expense from New York. And the fact that he doesn't know—well, some attitude is showing through here—but the fact that they decked this dude out, who again, shall remain nameless, expect everybody knows him and if you've ever seen *The Miracle Planet*, you know who I'm talking about. They deck him out in your REI down vest and I think they even got him a pair of jeans, you know, a real outdoorsy touch, and they positioned him in front of various scenic backdrops. The guy, and this had nothing to do with the fact that he was from the East Coast and his experience was very good, and I don't mean to put him down, but it turns out that the guy, big, huge name that he was, had a limitation in his delivery that I had never even thought of. The guy had the ability to move on only one emotional progression. He could only follow an emotional or a vocal progression down. He had no way to take something up to a climax.

The natural flow of language, actually spoken language as I am speaking to you now, it rises and falls, and the ability to hit a rising sequence or progression of ideas and to carry it with your voice and with the cognitive element is very useful in human communication. And if you strip that out, it's really very weird, especially for the author who goes back scratching his head going how can I write this all in descending emotions. How can I do this. It's not that easy, frankly, but it must be done because the medium must be served. And so we do these things, and nobody knows anything about it except, perhaps, the more intelligent and questioning and thoughtful of the audience there at three in the morning will wonder why it was done that way. The reason it was done that way, in part, had nothing to do with the science, although the science is crucial. It had nothing to do with a lot of things that would be obvious. It was, in part, formed by the vessel in which it resides, the medium being television. In this case, a key limitation was the talking head who was crucial to way the narrative was structured.

I could tell you stories of similar nature with regard to daily newspaper journalism, which is an art that Ross and I have practiced together. In fact, a small admission here, I hope Ross will not flog me for this later, but he and I go back to the Seattle Times in the late 1960s, and were reporters together, and so this is what happens. You start out as Jimmy Olson and you end up like this.

At any rate, I have practiced that craft, and it is a real art, and it's wonderfully refined. It's like a stone you pick up off the beach that has been smoothed by, in this case, practiced hands and honed for the purpose of communicating news; communicating information in an extremely efficient, honed down fashion. And for news, for new information of the sort you get in a daily newspaper, and on the TV and radio to an extent, is a wonderful thing, but its limitation is the depth of ideas that can be communicated.

I launched into my first book, *Mountains and Clouds*, primarily because I was covering the Boldt decision, which was the popular handle on what became the salmon crisis that never ends, for the PI. I had this feeling developing over a couple of years that there was really something very important here that couldn't be approached in daily newspaper stories. I mean I was writing daily stories and they were getting good play and having good fun and, you know, afflictingly comfortable and comfortably afflicted; all those things that get reporters going. But I had the feeling that I was never able to get at the core or the root of the story that really needed to be told. The relationships, the complex relationships of politics and public policy and natural resources and resource exploiting industries and the way they were working and they way they were shaping our lives and making the world that our children would come to live in. You could get at the firecracker going off. You could capture that pop and explosion of the moment, but putting that firecracker in a broader context was very difficult. So in that case, the vessel into which the information was poured to a significant degree for me, shaped the form of communication that came out of it.

The same is true of books. The strengths and weaknesses are different. The same is true for the web, where I now publish a journal that deals with this aspect of scientific inquiry and an effort to communicate it to a wider audience.

I would say in conclusion that the challenge is very similar across the various mediums even though the demands of the medium may be different. As a communicator, a person who makes building blocks of

understanding accessible to people, my fundamental challenge is to create compelling narrative; to tell the story in a way which touches the people who are exposed to it. And the tools and the way you approach it will differ, just as the story will differ from medium to medium. But to me the challenge is fundamentally the same, and frankly this may be part of me still rebelling against my parents, to tell you the truth.

My father was, for many years, a professor at the University of Washington. His specialty was Irish literature. He was the guy that everybody took classes on James Joyce from, you know. And my father specialized in a writer for whom the idea that the writer, the communicator has a responsibility to meet the reader halfway and to draw them in, was heresy. My father, you know, lived in a world where the writer existed on a higher plane and it was your job to haul yourself up to the top of the mountain. You could take a class from him and he would get you up there.

I don't, as a professional communicator, subscribe to that philosophy because, frankly, I think the ideas that we're dealing with here, the things that we're kicking around, and I and my colleagues have come here to share our thoughts with you about really matter. And they matter so much that they can't be left to the stray traveler who may stumble into the room and into some understanding or exposure. What we're dealing with matters so much that it must be communicated in a fashion that does justice to the ideas and allows people to make the right decisions.

You scratch a journalist and they start talking first amendment and they start talking journalism, but, you know, I really believe and second what Ross was saying. I believe in the multiplicity of voices. I believe that, for democracy to work, you have to put the tools in the hands of the public that will enable them to make good and reasonable decisions. And for that reason, our job, my job as I can see, that as a communicator, as a script writer, as a journalist, as an author, as a publisher, is to get that information in a form which is animated by narrative, which compels people, which communicates in a significant fashion and basically, makes this whole system work. That's, in a nutshell, what I try to do. To the extent that I may have succeeded at one small moment or another, this is what I think, I hope I may have succeeded at. So, I look forward to hearing from our colleagues, and I thank you for giving me a moment of your time.

Keith Seinfeld, KPLU-FM: I have a lot less experience than either Ross or Bruce, so I may not have as many stories to tell you. I've been doing this for about five years before I became a reporter.

I guess I should tell you what I do first, some of you may not know who I am. I cover the environment at KPLU Radio, which is one of the two National Public Radio stations here in western Washington. I've been doing that for about a year and a half, and before that I kind of hacked around between Seattle Times and Tacoma News Tribune and Seattle Weekly and some other local publications, and before that I was a high school English teacher.

Like Ross and Bruce, I do what I do partly because I actually enjoy the complexity of the type of the work that you people are doing. And we all sort of struggle against the language that you do it in, as Ross so articulately pointed out. We struggle against that, but we enjoy the struggle, ultimately, because we're interested in taking things that are complex and trying to put them into narratives and put them into language that a wide portion of the public can understand.

As a radio reporter – Bruce mentioned the limitations of television – you're one step further limited in that you don't have any visuals whatsoever. One of the first lessons that goes with any print reporter that wants to go into radio—there are a few of those at National Public Radio—is that you learn that you only get to say things once, and your listener is not a reader who can go back and check on, as he said, a definition or phrase, a location or a description. They only get it once, and so the crafting of those words becomes even more important. You're sentences become shorter. You stick with declarative sentences and you have to weed out a lot of the complexity that you enjoyed sifting through in the first place. And that can be really frustrating later on if you talk to one of the scientists you interviewed on a story and they generally liked the overall presentation, but, you know, there's a lot of things that didn't make it in

there. Maybe there are some subtleties that didn't make it in there or just specific things that had to get cut out because there's only so much you can communicate in a few minutes of story.

Fortunately at NPR, we have room to go five or seven minutes, occasionally, on a story. That seems like a long story when you're a listener, but if you printed that out, it wouldn't be as long as any feature story in the newspaper. And our standard stories, the ones you most often hear, even on NPR, our local newscasts are anywhere from 60 seconds to three minutes. That works out to about anywhere from three paragraphs to maybe eight or nine paragraphs. Think of what you can say in simple declarative sentences in that much time, and you see the challenge we're wrestling with.

So, while your task is to go into detail and document and as many steps as possible, we have to take that stack that you created and shrink it down into something much, much simpler, which is why we're so grateful when we find someone who can just say, the big fish eat the little fish. It makes our job a lot simpler.

I thought maybe I'd talk a little bit about some of the questions I get from scientists occasionally and a little bit about what it's like being a reporter. At KPLU, we have a fair amount of freedom, but at the same time, we're responsible for producing, usually, about three stories a week. And that's pretty common at a lot of newspapers also. Sometimes some reporters have to put out stories five days a week, but three to five days a week is not unusual, unless until you get to the ranks of being a senior reporter where you can work on long projects and stuff like that.

If you're producing three pieces in a week, you don't have a lot of time to do tons and tons of research and to talk to the seven or eight different people who have studied different aspects of the salmon life cycle. You know, you've got to get a couple of experts and hope that they can speak about their area of expertise, but also, speak a little bit more broadly about the field. That's one of the frustrations that reporters run into a lot—that scientists are specialists. They feel very comfortable discussing whatever they have published on, but if you get beyond what they've published, they're less comfortable. If you broaden out to what the colleagues on the same floor of the building are doing, they're uncomfortable, and they don't want to say anything. And we need people who are willing to say, here is where I am in the spectrum and here is the general spectrum and here is the terrain that you're trying to navigate. They are rare. I'm saying that to encourage you, when you get a call from a reporter, to keep that in mind. That more often than not, that's part of what we're looking for. Let me give you an example of some of the topics I've covered just in the last couple of months. I have selected out only marine-related topics, by the way. Covering the environment covers a lot of issues beyond marine issues.

Marine issues I have covered include sewage overflows, which are discussed in this conference; oil tankers and oil pipelines and the relationship between them and oil spills; new EPA regulations about chlorine dioxide and how they effect pulp mills. In this story I've had to address "what is chlorine dioxide anyway?" and "why is it different from other forms of chlorine?" It is a challenge to sort that out, where you have some activists that say all forms of chlorine are bad or some forms are bad and others who say otherwise.

In Puget Sound, I've also covered the state of the bottom fish—"what do we now about them?" and "what don't we know?" and "what should we know?" and "what do we wish we knew?" I've also covered herring populations—"what is going on at Cherry Point?" and "is that important or is it not important?" and "if it is important, how important is it?"

I've also reported on something called TMDLs, and I always have to stop and try to remember what that stands for—the Department of Ecology and some other agencies, I suppose, are supposed to figure out what daily load of different toxic components can go into any body of water. This involves analysis of dilution, which is another thing we have to deal with sometimes when we're writing about Superfund sites and cleanups.

I did a feature story on salmon farms. That was one where I talked to a whole lot of scientists, including a few who are here, not in this room, at this conference, and boy that was frustrating. A classic issue

where it's not even as nearly as complicated as dilution zones or chlorine compounds, I don't have to get into chemistry, at least, which is for me, the hardest of all the sciences to get into. But to get any sense of what really are the dangers of farmed Atlantic salmon in Puget Sound in terms of diseases or genetics or the feed that they produce and what antibiotics that may be floating in the water or dropping down to the bottom. Get a handle on that well enough to be able to come back and write a story. Again, come back from all that research and, where's the narrative? A narrative is a story with a beginning and a middle and an end. It's got a character or two in it that we can identify with. It has some personality. Well how do you get from ten different experts' evaluations of farmed Atlantic salmon plus a few activists who are against them plus a few businessmen who are trying to make a few pennies off of selling them. How do you get from that into narrative? That's the real struggle that we deal with.

Brown: Not to interrupt, but I think what you've touched on is really what the journalist struggles with, but I have the feeling that many in the wider population never know that struggle goes on. They think the narrative just pops right in there. I mean you just sit down until blood appears at the temples and the story writes itself. This is what reporters admire among each other: the ability to reach into that squirming mess and pull out the narrative and make a story out of it. But I think that a lot of people never realize that that's the challenge to many of us, to agree.

Seinfeld: That's the craft and the art, and the masters are the ones who can go in and find a narrative line that will tie the most obscure thing, the most obscure topic into something fascinating where, in a newspaper, where you'll actually turn to page 12 and follow the jump. That's the test. And in radio, where you can at least impress an editor long enough that he decides to let you have five or seven minutes to talk about it, and I tell you, when you mention salmon these days, you'd think there would be a lot of interest, but it's the other way around. People, certainly editors, feel like they've been over-saturated and they're really suspicious of any salmon stories.

One thing scientists often ask is "why was this a story but not this other thing"? I don't understand. Why was this type of research, why did that make it into the news and something else didn't. And that's one of those areas where you're getting into why journalists sometimes occasionally consider themselves members of a profession, because there actually is a body of knowledge that you learn through experience, and you learn through trial and error, and you learn through studying. And what makes a news story is one of those things that kind of separates people who can keep succeeding in this business and those who can't. It's being able to recognize a story. So it's not something I can tell you right off, what the difference is, but some of the most obvious things are timing, how fresh and new is the research. In some sense, is this something we haven't heard before or is it related to something else that may be in the news? Or maybe was in the news recently and people are concerned about it? And if you're wondering if something you're studying or something you've been looking into might be newsworthy, the most basic test I've ever been able to give people is, can it hold someone's attention at the dinner table. And someone who is not a scientist, for somebody who is completely out of the scientific field, can it hold their attention? What part of it does hold their attention? That'll tell you what's going to be of interest to a journalist more often than not.

When I call up a scientist or when I meet a scientist, I tend to, from the outset, respect that this person knows what they're talking about, at least within their field. You know, I don't spend a lot of time checking credentials, you want to know that those are there, but otherwise, you now, that's not the type of reporting I'm doing where I'm actually investigating the scientists.

The flip side might be useful for you to keep in mind. By and large, we do know what a story is, and we do have reasons why we're asking the questions that we're asking and doing the story that we're doing, and that's part of a two way street, I guess.

One thing you should notice that, one of the best things about doing environmental reporting and scientific reporting on Puget Sound is that most of you, or a lot of you, end up doing a lot of field research. And we love going out on field research, because we like to get out of the office too. It's one of

my favorite things. So that's kind of a few rambling thoughts. I'm really curious to hear what kind of questions you have and I'm really curious to hear what Richard has to say.

Richard Strickland, University of Washington: I guess I was added to this panel too late to be printed in the program. I think Dave was worried that if he put these three journalists here, they'd start devouring each other, so he thought he'd have a scientist here as a punching bag instead. But I'm actually not a real scientist, I just play one in front of students. I started out and got an advanced degree in Oceanography and never made it to my Ph.D. I wound up writing a book instead which some of you have heard of and Ross referred to earlier in the evening about Puget Sound.

From there I've basically been a writer and teacher. I don't do real research, although I can understand most of what's said here today, even some of those posters are a little over my head, so don't feel bad. I even did an internship, actually it was a fellowship, that's a little more prestigious, at a TV station once that was sponsored by the American Association for the Advancement of Science. I spent the summer of 1985 at the leading TV station in Miami, Florida, of all things, where science news is mainly geriatric medicine and emergency room trauma. I was there the summer of Miami Vice and the summer when, if you went too slowly on the on-ramp or the off-ramp to the freeway, there would be a young man with a big chunk of concrete to put through your windshield and then snatch your wallet or your briefcase or your purse, or whatever. So it was very educational for me to see what goes on inside a real, at least a broadcast newsroom in the spot-news capital of the United States, which they called themselves.

After that I spent six years as the science writer for the Washington Sea Grant Program, some of you may know about that program. I acted then and I still act quite a bit as a liaison between real scientists and people like these. I also teach freshman Oceanography at the University of Washington. Again, I'll go and listen to the research seminars and read the research papers and then digest that and spit it out at a level that freshman level non-science majors are expected to be able to at least get a "C" on, which I enjoy. I like being right in the middle between the "real scientists" and the "real journalists" and the journalists all see me as a scientist, and the scientists all see me as a journalist, so I turn my coat inside out and be whatever I want to be.

I brought my red pen up to the podium because I'm going to put on my teacher hat for a moment. I've had this clipping from the Seattle Times on February 16, 1997 with this young man's (Anderson's) picture on my bulletin board now for 13 months. I give it a "B." It's substantially correct, but it needs to be corrected in certain aspects.

To scientists, truth is determined only by data derived from experiments. Findings are tentative and qualified. They don't believe there is a last word on anything, correct. Reporters' scripture is the first amendment and the value of freedom of speech.

Correct! However the implication that there is conflict there I will mark incorrect, and will elaborate.

We believe truth can emerge from conflict. If you pick both sides on an issue, truth will ultimately win out. This is a concept that baffles most scientists.

Big red X. This is not an example of a true scientific meeting.

Anderson: I think what it says is that it "amuses most scientists."

Strickland: You may recall it, but here it says "baffles." If you go to a real meeting of specialists at the top ranks of research, you will find that the process of conflict is integral to science, actually. People will present one view. People will present an opposing view. They'll haggle it out. There'll be a stream of conflicting papers, and somewhere down the line, some people will win over more adherents than the others and one theory will come out on top.... This is a science lesson, I'm afraid, because I have to ask you, "Can I see your data? What's your sample size?"

Anderson: It consists of one guy in a small room out at NMFS.

Strickland: I think I know the gentlemen.

Anderson: That's enough of a data sample for a journalist. "Anonymous source." In fact that's a rather large sample.

Strickland: I can see why you chose that profession. You are entitled to this view point, but a scientist I would qualify this statement by saying, "in my experience," or "I have a feeling that." The essence of science is not to dismiss the mystical or the intuitive or whatever, but to properly label it as such and then to have a separate logical process that can be understood by anybody in which you assemble evidence. You weigh it. You present conflicting explanations. You weigh those, and so forth. There is a stereotype of a scientist as a loner, but I really have to call it a stereotype because, in my experience, oceanography (for example) is getting to be more and more of a group science. You have to go out on a research vessel. A research vessel costs upwards of \$20,000 a day to operate and the problems are so big that no one person can attack it solo. It's not like Thomas Edison with his light bulb in his lab, or whatever, anymore, and I suspect that most sciences are that way now too. Genetic research, etc. People have to cooperate and those that are not able to cooperate are very quickly shunted off to the sidelines, the cold fusion arenas of science.

There was a little e-mail exchange prior to this meeting, and I'm being pretty much responsive. I'm not so much contributing my own stuff as reacting to things other people say, but I wanted to defend scientists on two grounds. Number one: the right to be complex and specialized. That's really the only way that science has advanced, and the farther we go, the more that's true. And the right of the scientist not to comment or not to form a judgment, even though the press may want one. I'll give two examples, just in the last 24 or 36 hours. We've had our own research vessel from my own department go out on Lake Washington and shoot off some air guns, to see that the air guns worked before they take them out on Puget Sound to look for earthquake faults. I think everybody would like to know where those are and when they are likely to go off and how severely and so forth. So later some people reported some dead fish floating in the lake, and to its credit, the Seattle Times headline was something to the effect of, "Fish killed found in lake after air gun testing." In other words, they didn't say air guns kill fish. That would not have been a scientific conclusion. They restrained themselves from that, but no scientists would want to jump the gun and prejudge that one way or the other, as tempting as it might be for journalistic reasons. There are all sorts of possible alternative explanations. There are all sorts of evidence that could be gathered before having to draw that conclusion.

I want to give another example: the asteroid. Yesterday at this time an asteroid was going to come within 26,000 miles of the earth in the year 2028, they know the day, October 26th or 16th, and you know their calculations were a little shaky and it might hit the earth. That's pretty close. That's closer than some of the geosynchronous communication satellites that send our cable TV back and forth. Today, it's 600,000 miles. They went back to 1990 photos, found the asteroid in places where they hadn't seen it, and recalculated the trajectory. Now it's going to be twice as far away as the moon. So you don't want to really jump to conclusions if you can help it, much as the headline that an asteroid is coming is valid, but to say what it's going to do would have been very premature, and probably still is fairly premature.

So scientists live and die, basically, on accuracy. Journalists live and die on selling newspapers or attracting listeners to their station, whatever. And those two can come into conflict, I agree. I'll also agree that the better the scientists can communicate what they're doing and how they're doing it and so forth, the better. There's no defense of scientists being poor communicators, although you can't expect every scientist to be a good communicator any more that you can expect every journalist to be a good scientist. They are different specialties.

I want to draw an analogy to what journalists respect in certain other fields: confidentiality of information in certain circumstances. For example, the attorney-client privilege and the doctor-patient privilege. Now I know leaks are a very popular thing. They are unethical but they happen. But there is at least a principle that's established in both ethics and law about information remaining confidential under certain circumstances. And there is at least lip service given to respect for that. So I argue for recognition of that in the scientific arena. There's a scientific process called "peer review" in which a scientist makes a draft paper of a preliminary conclusion or something like that and, present company

not necessarily accused, but I've heard criticism from the press types in the past that, well, you know, "This guy has written this paper so why is he sitting on it? Why can't we publish this? Somebody's trying to squelch information that public tax dollars paid for."

The process really is that a draft is just a draft and there is established hierarchy of review by which you first share this people that you're friends with, and ask them to tell you what they think is wrong with it or what are the good parts or so on. Then it gets sent to people whom you don't know, who may be your enemies, who are trying to get that research grant instead of you and they try and pick it apart. And only after it passes all those tests are you ready to stand behind what you're going to say to the public. Now some people are confident enough to say things before that, but I don't think it's the place of the press to be trying to tamper with that process and accuse scientists of greed or dishonesty or anything like that by keeping the review process confidential, by keeping findings confidential until they've gotten the proper scientific exchange of ideas to where then they are ready to go public with that. Public agencies that conduct science are subject to slightly different constraints because of law about open information and so forth. But even then there's been a controversy with the public National Research Council, which is run by the National Academy of Sciences, when they try and come to conclusions about important scientific issues in the country. I believe that there has recently been a court decision that has forced them to open up their review process more to the public and the press than they previously had, which makes scientists very uncomfortable. Again, if you can't talk in a confidential fashion with your scientists about what do you think about this idea, do they think it's crazy, do you think it makes sense—if you're going to have to start tiptoeing around worrying that the walls have ears all the time, then that's going to compromise the scientific review process, which I think is unhealthy.

I think I've covered about everything that I wanted to here. I'll stop there and I may remember other things in the discussion. Thank you.

Q: Ross, you have no science background whatsoever? It seems like a really good idea to take an environmental science just at a general level to give you a good idea of the systems that are involved.

Anderson: I agree. My guess is that my lack of any formal education in natural sciences is worse than most of my colleagues. I worked at it. I struck a deal with a biology professor. I'd taken another course from him earlier, and he said he'd give me a "D" if I promised never to take another class from him. You're dead right. Now mind you, I consider my profession to be a year round never-ending graduate school. I mean, what I do is I go to school for a living.

I'm learning this evening. Richard's points are fascinating. Now that's going to enlighten me on marine biology, in terms of the ethics of science. I would love, and still plan to take a year off and go back to the UW. And I will do that. Of course, by then I will probably be retired.

Mearns: I work with NOAA and I've been involved in oil spills of the past ten years and wastewater treatment and sewage issues for the 15 or 20 years prior to that, and I guess what worries me from this conversation is I don't see how we are going to learn from the past. Is there a way that we can collectively analyze past situations where science and policy have clashed, resulted in a product, an action, that cost the public billions of dollars, in the future. For example, today we've been hearing about wastewater discharges and new outfalls, and so on, and Puget Sound modeling, and I haven't heard one word about what went on in the previous decade in the media and in the decision process. The decisions, as far as many scientists are concerned, were controlled by a few specific scientists that the media went to. In looking at the future, in the next two, three five years and so on, as these issues come back to the surface again, it seems to be there's no mechanism for going back and looking to see what we did and how we decided something in the past, so that we can build on that, at least in evaluating the issues again in the next decade.

I'm not sure I'm making myself clear, but scientists carry with them a long-term history in their field of what goes on, what the decisions were, how the data was used, how they build on a story over a five, or

ten or twenty, or thirty year career. But they are dealing with the media in little chunks, episode of events and decisions and policy. Maybe you guys can help me define the problem.

Sale: If I could paraphrase Alan, I think there's a certainly continuity that you have when you work with something a lot that you know the past, you've followed a certain story and when a reporter picks up that story at one point they don't have that continuity.

Brown: You are speaking to something that is very real, and it is an institutional problem in the news media that extends beyond the coverage of scientific issues. I think for instance of Bruce Chapman. Bruce Chapman was a two-time a city councilman in the city of Seattle. He later went on to be a minor force in the Reagan administration, and came back to Seattle twenty years later, and there wasn't anyone on the desk of the daily newspapers who remembered that he was from Seattle. This sort of short term memory loss which is a function of, well, if Ross cares to he probably could speak more to the administrative and structural natures that produce this kind of thing. But you see it all over the place if you have any history in a town or a discipline of study or an area of interest.

Actually, I was thinking of the issue of Atlantic salmon and the farming of Atlantic salmon in pens, essentially, in Puget Sound. I believe I wrote the first story on that subject in either of the major dailies in the city of Seattle. It was written in the mid-1970s, probably about 1975. There was nothing in the PI morgue on any of this when I went into it. I can't speak to the Times, but the PI was actually more aggressive on that subject at that time. And I would guess probably that the PI's morgue would also be reflected in the morgue at the Times. So, I'm just a reporter, a cog in the machine, a functionary doing my job. Well, I developed some knowledge on this subject. I have some history. I actually go back to the beginning, I would say, of the discussion of these issues in this community. Well, I haven't written on that subject in 20 years. And the reporters flow through. New people replace old people. The collective memory becomes diluted and I don't know what we do. This kind of wanders off into structural questions of journalism. Do you have any comment on that, Ross?

Anderson: It works both ways. I'm thinking of a conference on covering the oceans down at Scripps I attended about a year ago and it was a fascinating conference. It was about four or five days. It was sort of half scientists from Scripps and elsewhere and the other half of us were journalists. It was a terrific gig, but I think it was the first or second night we had a dinner right there at the campus and they served salmon. And everybody I was sitting at the table with – the environmental reporters from the LA Times and the New York Times and a couple of the oceanographers from Scripps – was remarking on the irony of serving an endangered species at a conference on oceanography. Well I tried to explain to these folks that yes, while we have serious problems with salmon in Puget Sound and the Columbia River that throughout most of the range of Pacific salmon the biggest problem is a glut. That there are too many; partly because of farms but partly because of, what is it, fourteen consecutive years of record runs in Alaska. There is too much salmon on the market. And prices have plummeted. Well I made my case for fifteen minutes or so, and at the end, nobody at the table was buying it, including the two oceanographers. I guess my point is, we all buy into, we all have sort of short memories, and buy into mythologies which journalists and scientists are equally obligated to try to dispel. But it's always going to be a tough bite. The myths are always bigger than the truth.

Q: I just want to speak to this point. I feel like an interloper like a journalist because I am an historian in training. I have to shuttle between reading past accounts in newspapers, particularly in Seattle newspapers before World War II which were notorious news publications and then shuttle back and forth between your reports and my own research in environment history. One of the problems: writing histories is a very good idea, but in my work in history of science and environmental history, I've often found that some of the narratives that I'm writing to try to frame the complexity of what the scientists do, are met with a great deal of hostility.

Brown: What kind of a narrative do you mean?

Q: I wrote an article about Lauren Donaldson and his research, and I basically, decided after a while that with the exception of the folks in fisheries, that there were certain people that were invested in the

hatchery regime that Donaldson supported. And another friend of mine who is higher up on the food chain, he's now a professor, but basically he's provided the first comprehensive environmental history of Pacific salmon. And he's been able to conclusively demonstrate that there was widespread belief amongst scientists to support hatchery regimes. And the people, there was research as early as 1918 showing that hatcheries were ineffective and were damaging the stock.

Brown: In fact there was no concrete evidence to support that they had any positive effect, whatsoever.

Q: Yes, and that was suppressed by people like Spencer Baird and Bart (?). Well, when he presents this information in certain circles, he's met with a great deal of resistance. So I guess the question I'm posing to scientists and journalists alike, is when someone like me as an historian comes along and wants to destabilize these narratives and tell you the stories that creates a great deal of resistance. How are we supposed to communicate and then present our version and complexity to a general audience when we're unseating positions a privileged scientist holds and also challenging journalists? As someone who does have the luxury of doing research provided there's a job out there, to tell a more complex story than you can on the op-ed page?

A: I'm reminded of two things. One is the movie *Viva Zapata*, with Marlon Brando, where he leads a revolution and then finds himself behind the dictator's desk with a young scruffy man, and he's saying to that young man, 'What's your name?' and then he suddenly realizes what he's done. He's become the establishment, and he is punishing the revolutionaries, and so he walks out. And there's also the book by Thomas Kuhn, "The Structure of Scientific Revolutions." The prevailing paradigms always become the establishment, and if you're a rebel, you had better expect a fight. I think it's an occupational hazard.

Brown: As an aside on Lauren Donaldson, I remember sitting in his office in the mid 1970s and raising, I had the feeling from the vehemence of his response, perhaps for the first time to his face, the idea that genetic diversity was an issue which, if examined in detail, at the very least introduces complexity into the hatchery picture and at the other end of the spectrum, identifies the fatal weakness of the hatchery paradigm. And Donaldson waved his hand and said, "There's plenty of diversity. We've got all the diversity we need." Speaking to the scientist and the obligation of the scientist, I will have to say, as a journalist who knew that Donaldson had also supported the plow share program which was never enacted but publicly planned and discussed. [An] idea to create a year round harbor in Alaska by detonating atomic bombs above the Arctic Circle. and Donaldson had signed off on this sucker. Knowing this, among other things about Loren, I came with skepticism and was prepared for a fight. And that's part of what Mountain and Clouds was about; exactly that struggle over that paradigm and the effort to raise the issues, to put the ball in play in public discussion.

Comment: Hopefully the scientific process is designed to overcome the individual scientist who may get hide bound in his or her beliefs that do not stand up to new paradigms.

Brown: Well, he was very successful. It's a double-edged sword. His success became his great weakness. It's human. It's the way we all are.

Strickland: I had a talk with him once about radioactivity. He was in the group that went down to the South Sea Islands after World War II to look at the impact of nuclear testing down there, and also was in a group looking at potential leakage of Hanford radiation into the Columbia, and actually there was some leakage earlier, and it's not over yet I'm sure. He just said, "Hey, radioactivity is great. It never hurt me." All of his colleagues are dead and died fairly young of mysterious diseases, but he is still alive and so he can be reinforced in his own beliefs.

Brown: Lauren Donaldson was a real figure of some substance, and did some good. The thing is that we all strive to attain an ideal, and the ideal for the journalist may be in some ways substantively different from the scientist, although, I have been very interested in your comments. You've opened my eyes to some things that I hadn't really grasped. And I think maybe there are analogs there that I didn't perceive before, but none of us attains the ideal. You get up every day and you try to do the best you can and sometimes you do and sometimes you don't. We try to tell your story.

Q: This is just to follow up on the first question that was raised. As many of you may know, young scientists are having a harder time finding jobs than our predecessors, and I'm wondering, to the journalists, are people with masters degrees and Ph.D.s in science becoming journalists. Are you recruiting them actively? I'm not talking personally, but I just feel like that would be a great, I mean there are not enough jobs for all the young scientists that are being trained in all mediums right now.

Anderson: I think that it would be overstating to say that anybody's going out and recruiting scientists, but science journalism is one of the growth, I mean, journalism is very prone to fads. We went through the fad of business journalism during the 1980s and into the 1990s, and I think that's waning. And one of the emerging fads, which I think is wonderfully healthy, is science journalism. You look at the Tuesday science section in the New York Times, which is considered to be a model in the industry now. When Bill Dietrich quit, we all wanted go out and slash our throats, and then Henderson took over, and picked it up extraordinarily fast and she's doing terrific work in my opinion. But are you going to be able to take a Ph.D. in chemistry and go to a newspaper and get a job? No. But one of the roots that a lot of scientists overlook is that, I can understand if I was a scientist why I would be reluctant to take five years of work and trust it to an ink-stained wretch such as myself to interpret to the rest of the world. I'd work pretty hard at it and probably do a reasonably good job, but there are other ways of doing it.

I've spent five years on the editorial page at the Times, and every day the Times runs at least one, usually two, op-ed pieces. We are desperate for good science on that page and several times I have been out to the UW and talked to brown bag sessions with faculty, trying to give faculty and students some clues as to how to write a decent op-ed. Because we get relatively few submissions, even though we're only a few blocks away from the UW, and those we do get are mostly unprintable. You read the piece, and you can tell that this is somebody who is very smart, somebody who has something important to say, but, darn it, isn't saying it. I've got a one page lists of do's and don'ts about how to do an op-ed. Now does that mean one can do it? Not necessarily, but if one just follows a few simple rules, the op-ed page is a great way to get your message into the newspaper. And I think that similar devices exist elsewhere without going through the filter of a reporter.

Q: So you're saying that scientists are welcome to write good articles and they are likely to get published first.

Brown: My take on that is that, one of the curious things about journalism is that it is, in a way, open to all. You can get a journalism degree, but you sure don't have to have one. You can get no degree at all. One of the things that's very egalitarian, and I think refreshingly so, about the journalistic profession, historically and generally, is that all it requires is that you can get the job done. And if you come in with a passion for science, and background for that and you can tell a story, and do it on a deadline, then there will be a place for you. But if what you're saying is, will a glistening degree, in and of itself from a reputable institution of higher learning in a scientific field, make them say, 'Wow. You're our boy.' Not in and of itself, but it can in combination with other skills that you or your colleagues may possess; would make for a real killer combination that is welcome in many places in the profession. The degree itself, no, but if you can do the job and come with passion, absolutely, I'd say.

Q: I'm not necessarily looking for advice on how to get a journalism job, but I'm just saying that there is an opportunity out there for educated scientists to become journalists and maybe that should be looked at on a nationwide level, perhaps, more than it is.

Brown: Couldn't do any worse than we're already doing.

Q: How do you decide where to set the bar in terms of being an educator as well as a reporter? In other words, how do you determine who you are talking to when you write a piece, and do you consciously make them learn something, work a little bit to understand the piece, rather than just have it fed to them in the sense of learning science?

Brown: Ross, what are the assumptions that the Seattle Times brings to its table?

Anderson: I think that varies widely from one reporter to the next. [End of recording.]